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Sola Gratia: Grace in the Engineering Curriculum and Profession

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Sola Gratia: Grace in the Engineering Curriculum and Profession

Abstract

Integral Christian higher education is in vogue. Most Christian institutions of higher education who take their mission seriously make the claim that the education offered to students is one where faith and learning are not separate. It is a belief that their entire educational enterprise is inexorably tied in some way, shape, or form to our new life in Christ. Most engineering programs on Christian campuses are the outgrowth of this perspective. Over the last fifty years, numerous philosophers, writers, scientists, and engineers have developed a solid foundation from which engineering can be understood as an essential calling in the kingdom of God.¹ Central to this work has been a revival of the Biblical theme of creation, the mandate for culture formation, and the proclamation of the gospel through engineering work. The dialogue has often focused on developing a Christian motivation for our engineering work rooted in a Biblical understanding of Creation or on defining what constitutes “right” engineering action (ethics, responsibility, morality, witness...) from a Christian perspective. While I applaud these efforts and find this work indispensable for our task in engineering education, our work to date has yet to plumb the depths of another theme that thoroughly pervades scripture. This Biblical theme is the unpredictable, indeterminate, and irrational grace that characterizes life in the kingdom of God. When it comes to engineering education (which seems at home in the systematic and rational environment of laws, rules, regulations, and responsibility), grace is often either relegated to a personal sphere or is conveniently left for elsewhere in the curriculum. If the epoxy of grace is so bound up in the fiber of the kingdom of God and we claim that faith and engineering are not separate, then the trajectories of engineering and grace must somehow intersect. This paper will begin by establishing a biblical hermeneutic for understanding engineering in the light of scripture. It will illustrate from scripture that “grace” is not simply a theological concept or a mechanism for salvation. It is a way of life. Using the work of Christian philosopher Albert Borgmann on technology and grace as a starting point, the paper will explore how grace is woven into our work as engineers. An example of how “grace” might color a course in the engineering curriculum will be presented using an Instrumentation and Control Systems course as an example.

Keywords

Christian education, faith, learning, grace, Bible, hermeneutics

Disciplines

Christianity | Educational Methods | Engineering Education

Comments

Presented at the 2015 Christian Engineering Conference held June 17-19, 2015 at Seattle Pacific University in Seattle, Washington.

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Ethan Brue¹

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This paper will begin by establishing a biblical hermeneutic for understanding engineering in the light of scripture. It will illustrate from scripture that “grace” is not simply a theological concept or a mechanism for salvation. It is a way of life. Using the work of Christian philosopher Albert Borgmann² on technology and grace as a starting point, the paper will explore how grace is woven into our work as engineers. An example of how “grace” might color a course in the engineering curriculum will be presented using an Instrumentation and Control Systems course as an example.

Grace: The Rosetta Stone of Scripture

There are certain concepts in physics or engineering that resist explanation. Instead, they beg for illustration or experience. The concept of force is an example. Attempts to create a definition, equation, or essay on force, will lead a person no further toward conceptualization than if you forego words altogether and simply lean on someone. The absence of words creates the most complete and most correct definition. This is what

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force and grace have in common. Rational explanations often confuse rather than clarify. Just as force begs for experience, grace begs for story.

For example, this is what grace looks like.

The Parable of the Sower (Matthew 13:1-17, NRSV)

That same day Jesus went out of the house and sat beside the sea. ² Such great crowds gathered around him that he got into a boat and sat there, while the whole crowd stood on the beach. ³ And he told them many things in parables, saying: “Listen! A sower went out to sow. ⁴ And as he sowed, some seeds fell on the path, and the birds came and ate them up. ⁵ Other seeds fell on rocky ground, where they did not have much soil, and they sprang up quickly, since they had no depth of soil. ⁶ But when the sun rose, they were scorched; and since they had no root, they withered away. ⁷ Other seeds fell among thorns, and the thorns grew up and choked them. ⁸ Other seeds fell on good soil and brought forth grain, some a hundredfold, some sixty, some thirty.” ⁹ Let anyone with ears listen!”

¹⁰ Then the disciples came and asked him, “Why do you speak to them in parables?” ¹¹ He answered, “To you it has been given to know the secrets of the kingdom of heaven, but to them it has not been given. ¹² For to those who have, more will be given, and they will have an abundance; but from those who have nothing, even what they have will be taken away. ¹³ The reason I speak to them in parables is that ‘seeing they do not perceive, and hearing they do not listen, nor do they understand.’ ¹⁴ With them indeed is fulfilled the prophecy of Isaiah that says:

‘You will indeed listen, but never understand,
and you will indeed look, but never perceive.

¹⁵ For this people’s heart has grown dull,
and their ears are hard of hearing,
and they have shut their eyes;
so that they might not look with their eyes,
and listen with their ears,
and understand with their heart and turn—
and I would heal them.’

¹⁶ But blessed are your eyes, for they see, and your ears, for they hear. ¹⁷ Truly I tell you, many prophets and righteous people longed to see what you see, but did not see it, and to hear what you hear, but did not hear it.

There is a sense of mild angst when Jesus is pressured into turning this story into an explanation. The gospel of Mark (Mark 4:13) records that he said to his disciples “Don’t you understand this parable? How then will you understand any parable?” implying that an explanation is really not needed for those who are seeing with “kingdom vision” and without this “kingdom vision” resorting to explanation only depreciates the story’s power. As SparkNotes are to a novel, so is the explanation to the parable. Jesus knows this. The most frustrating part of having to explain the parable is that the Rosetta stone for understanding this parable is “in their face” (Luke 17:21). The key to understanding any and all parables is Jesus himself, the Word made flesh, the embodiment of grace

(unfailing love) and truth (enduring faithfulness). As Jesus states, many prophets and righteous people longed to see this living Word present among them in the here and now.

As people of the living Word, our challenge is to resist further dissection of the explanation given, and look at the story itself in the light of the storyteller. First point. The story is about a farmer. We miss this point often. We so often want to make the story fundamentally about seed. Second point. This farmer is neither efficient nor smart. He is clearly not a science or engineering type familiar with cost-benefit analysis, optimization algorithms, or even basic agronomy. He irrationally and without proper planning recklessly wastes a large amount of seed in places that have little or no chance of growth. That is the main point. The follow-up explanation to the disciples is not intended to reiterate this main point. The disciples were puzzling over the details and Jesus was patient enough to address the specific questions on their minds. Even today, there is little need for explanation on the seeds. If we are listening to our lives, we are quite well versed at practicing a vast array of no-growth strategies in our day to day interactions. While this is an important reminder for disciples of any era, there is no hidden mystery about this facet of the parable.

When Jesus refers to the revealing of “secrets” and “mysteries” of the kingdom of heaven, he is referring to his presence among them. If as contemporary disciples we can finally see beyond ourselves long enough to see kingdom of God in our midst we will take the parable of the sower at face value and understand. It is the parable of the prodigal (i.e. reckless) farmer, not the parable for identifying common causes of insufficient germination. The story is one of radical grace. The Rosetta stone of Scripture is grace.

Foundations for a Biblical Hermeneutic

Before expounding on this thesis that the lens of grace is essential for understanding all of Scripture, it is helpful to establish a few principles of how Scripture lives and breathes through our daily lives, from our worship to our engineering. These are only considerations for a Scriptural hermeneutic, not an exhaustive how-to guide.

First, I am going to avoid the term Biblical fundamentalism even though it is part of my faith tradition. It is a term that has been so confused and misinterpreted inside and outside the church that it no longer helpful or valuable for clarification. It either carries the baggage of being too narrowly wrong for some, thus functioning as an ostracizing label. Or it is interpreted to narrowly right for others, thus functioning as a pharisaical label. More recently, it has evolved into a term used in popular media to define those who, fueled by religious beliefs of all types, take matters into their own hands and resort to violent extremes (physical or psychological) to assert their views. Ultimately, when a culture uses a term for too long, it tends to lose its ability to communicate anything beneficial. That said, if there is any thread of continuity in the various manifestations of Biblical fundamentalism essential to maintain a meaningful hermeneutic, it is as Roy Clouser observes that most fundamentalists “...have retained the idea that religious faith should guide the whole of life.”³ However, due to the confusing cultural baggage tied up in the term fundamentalism, this paper will use the term “radically Biblical”, a term that Roy Clouser has coined to describe an “essentially” or “strictly” Biblical position.

Basing his definition on underlying principles found in Psalms, the prophets, and the New Testament, Clouser states...

...there is no knowledge of truth that is neutral with respect to belief in God. The {Biblical} writers who assert this do not also specify exactly how belief in God impacts “knowledge of all kinds” or “all truth”, but they are clear that they regard beliefs in other (putative) divinities as partially falsifying all that is taken to be truth or knowledge, and that knowing God enables us, in principle, to avoid that partial falsehood.⁴

While being comprehensive on this score, the Bible is quite terse when it comes to theology and doctrine. It is also short on sociology, business, biology, chemistry, or any other discipline you might want to seek Christian wisdom on. More specifically, any discipline that has predominantly defined its modern identity in the last few centuries (i.e. engineering) will find perplexing the Scriptural ambivalence to its disciplinary concerns. Modern readers of Scripture have tried to compensate for this by either asserting that scripture only illumines the “spiritual” spheres of our existence, while knowledge in the disciplines are discovered through conventional methods of rational conjecture or empirical methodology. Well-meaning Christians loosely use terms such as general revelation or common grace to address this apparent silence of Scripture on the subjects. Others simply are content to shoulder the cost of sporting different outfits for each occasion, the every-day uniform for ordinary life, and the spiritual suit for more religious affairs.

None of these responses to Scripture’s ambivalence are satisfactory from a radically Biblical perspective. **ALL** knowing is guided and directed by religious belief. This religious belief comes from the creator God through the living word, Jesus Christ, as revealed to us in scripture through the power of the Holy Spirit.

Second, the only Biblical story is the whole Biblical story. In one sense, this is to say, context always matters in exegesis and hermeneutics⁵. But recognizing context is only one part of this assertion. The entire Scriptural narrative depends on all other Scriptural narrative regardless of its literary forms (i.e. early covenant story, wisdom, prophecy, gospel story, church letters, etc.). There is no complete creation story without the complete redemption, and reclamation story. For example, the most complete and accurate creation story comes not from Genesis, but rather from Colossians 1 and John 1. Standing where we are in the story of God’s people, it would be impossible to understand Genesis without the gospel of John and the subsequent letter to the Colossians. There is also no redemption or reclamation story without an all pervasive fall narrative and the experience of brokenness. Likewise, there is no understanding of the creation story that can circumvent our clouded lens of the fall. Without the Light who was before and in all things, there would be no seeing or hearing at all.

Which brings me back to my original thesis on Biblical hermeneutics. The Rosetta stone of Scripture is grace. The gospel on John says this best...

In the beginning was the Word, and the Word was with God, and the Word was God. ²He was with God in the beginning. ³Through him all things were made; without him nothing was made that has been made. ⁴In him was life, and that life

was the light of all mankind.⁵ The light shines in the darkness, and the darkness has not overcome it.

¹⁴The Word became flesh and made his dwelling among us. We have seen his glory, the glory of the one and only Son, who came from the Father, full of grace and truth.⁶

Grace and truth are two sides to the same stone. Unfailing love and unending faithfulness are synonymous with grace and truth.

Reading scripture without the Rosetta stone of grace makes a substantial difference in our scientific and technological world. For example, a strong case could be made that both sides of the origins debate in the Christian community have been plagued by the absence of this interpretive key to scripture. The two predominant polarized views of the origins debate are products of the graceless technological secularized framework⁷. One side reads scripture into a secularized framework, the other reads scripture out of a secularized framework. In contrast, the unlocked Genesis story is a rich gracious song of delight, in which the background chorus keeps ringing “it’s good” again and again, the musical pattern clearly is established to emphasize the key relationships. God is God. Creatures are creatures. The musical journey takes us through a cadenza of two other important creaturely relationships beyond the creator to creature distinction. These are the relationship of humans to the rest of creation, and the relationships of male to female. All of this comes together in the finale of goodness and celebrative rest.

The Genesis story is a primer on grace because it is fundamentally a story about relationships. It is a dynamic story that must continually change (unfold, develop, and grow) to stay alive. Predictable or “mechanical” music is bad music. To comment that someone is a “technically” good musician is a nice way of saying that they really are not a musician yet. Predictable and controlled relationships are always unhealthy relationships. Healthy relationships beg for contingency, dependency, mystery, and risk. Such are the relationships established in the creation story.

Cultural Barriers to the Radically Biblical Hermeneutic

The problem however does not reside in simply correcting misguided methodologies and assumptions about how to read scripture. The deeper problem is that from our modern cultural vantage point we have managed to find ourselves in a position from which it is impossible to see Scripture. Herman Dooyeweerd refers to this as the secularization of science which as he says

“It is vain illusion to suppose that the Christian faith has only to do with the world beyond and nothing to do with science! Secularized science profoundly affects the human heart. From the very moment one accepts it, it accompanies him when he reads scripture and when he says his prayers.”⁸

For Dooyeweerd, secularization is not first realized in the rejection of belief, but rather in the declaration of autonomy and the absence of a contingency culture. Albert Borgmann describes this roadblock to the contemporary hearing of the Word, as follows...

“Many of us share the intuition that contemporary life is uniquely inhospitable to Christianity...Our culture seems indifferent to the real message of Christianity and at the same time is eroding the ground that Christianity needs to prosper. There are head-on attempts at bringing Christian doctrine to bear on the life of our society, such as branding our culture as materialist, trying to promote prayer in school through legislation, and seeking to outlaw abortion. But for all their directness, these attempts appear to have little purchase on the deeply underlying problem. Something less direct and more reflective is called for.

A first step in this direction is to recognize that the indifference of contemporary culture to Christianity is, theologically speaking, a problem of grace, of God's presence in our world...Grace is always undeserved and often unforethinkable, and a culture of transparency and control systematically reduces, if it does not occlude, the precinct of grace. A technical term for what lies beyond prediction and control is contingency. What we need to recover then as a condition of receiving grace is the realm of significant contingency.⁹

This is the problem. The fabric of modern techno-scientific life has created an environment in which we have no other alternative but to exclude the very interpretive heart of the gospel. Just as Neil Postman¹⁰ suggests that certain messages are either incompatible with or redefined by the technological medium used to communicate them, so we continue to try to share the gospel through a cultural medium incompatible with the message. Not only is the cultural medium incapable of conveying the message, the immersion in our techno-scientific culture slowly trains us by habit to engage the message in ways that will re-wire us unreceptive to the message, even if the medium was capable of communicating it. Our technological culture, with its new habits of doing and thinking, has stunted our Scriptural imaginations, analogous to what the internet culture does to our ability to read and know.¹¹ The frequencies of grace in our world have become nearly inaudible to our modern techno-scientific mindset.

Modern Engineering as Antithetical to the Gospel

As modern engineers who have been shaped by over a century of scientific hegemony in our field, Borgmann challenges the Christian in the field of engineering to respond to his assertion that modern technology forces a scientific agenda that demands that we pursue the transparency and control of all of life. Transparency as a problem solving practice assumes that all solutions begin with dissection, disassembly, removal of interconnections, and categorization of the parts. The problem solving practice of control assumes that knowledge of the parts leads directly to the independent control of the whole. In contrast, the culture of grace never embarks on a journey without dependency and contingency.

The modern manifestation of engineering in both education and profession is antithetical to the precinct of grace, which renders engineering (and modern science) foundationally incompatible to the gospel. A brief characterization of the last 100 years of engineering education suggests that Borgmann is correct. The nature of engineering (and STEM)

education is uniquely resistant to grace. Modern STEM education is defined by the following practices:

Analyzing (Transparency): The preponderance of early engineering education (despite valiant efforts to change) remains firmly in the grip of the analysis culture. We consciously and subconsciously train engineers that knowing is power and knowing in mathematical abstraction is the highest form of knowing. By our prerequisite traditions, we declare that before you can know anything else of significance, you need to know mathematically. Other methods of knowing, empirical, experiential, or imitational are but imperfect short-cuts needed to fill in the blanks until mathematical knowing can catch up to experience. A diet of calculus, physics, chemistry remains status quo for most college engineering freshman, and the majority of these courses (even at Christian institutions) are taught with the presupposition that to “see through” things, you need to look at them mathematically. As C.S. Lewis recognizes, there is a difference between looking at and looking along¹².

Modeling (Predicting): Reinforcing this notion of the power of math is the apparent success of mathematical reductionism as a means of taming our world. Fear is a creation of the unknown. Explaining or naming something is often a means of eradicating fear. Being able to predict, even if the predictions are dire, is a means of achieving temporal comfort. Asserting that math is describing the created world is not declaring anything new. As a creaturely language, math has nothing else to express other than what is created in our minds and in our day-to-day experiences of created order. Math cannot transcend creaturely limitations. Human experience can be depicted through math with its ability to bring out the rational hues in creation. Nonetheless, the very premise of the modern scientific engineering is that if you cannot model it, you cannot engineer it. This thesis does not find support either experientially or historically, but it remains the modus operandi of modern engineering.

Optimization (Controlling): Analyzing and modeling are not the property of engineering. Engineers are invited guests, but only if we promise to play by the local rules that lead to transparency and predictability. Optimization is the engineer’s original contribution. Optimization reduces all potential solutions to one right answer. Since the turn of the 20th century, underlying all scientific engineering and management systems is the belief that scientific methodology will yield the solution most consistent with “natural law” in all spheres of culture. Contrary to popular perception, optimization does not “find” the best answer. Optimization is only a means of reinforcing the currently trending notion of progress. In the process of optimization the limited range of right answers is already decided upon before any calculations begin. Optimization is a means of control. Optimization looks at the process, not along the process to the legitimate need. As a result, engineering solutions that circumvent mathematical methods of optimization are often derogatorily referred to as “blow-torch engineering” or “seat-of-the-pants” creations, even when the end result effectively meets a real need.

Efficiency (Valuing): Analyzing, modeling, and optimizing all find convergence in the modern gospel of efficiency. The quintessential modern engineer Fredrick W. Taylor aptly describes this new creation-fall-redemption motif that animates modern culture in his marquee work *Principles of Scientific Management* by declaring...

This paper has been written:

First. To point out, through a series of simple illustrations, the great loss which the whole country is suffering through inefficiency in almost all of our daily acts.

Second. To try to convince the reader that the remedy for this inefficiency lies in systematic management, rather than searching for some unusual or extraordinary man.

Third. To prove that the best management is a true science, resting upon clearly defined laws, rules, and principles as a foundation...principles {that} can be with equal force to all social activities: to the management of our homes; ...our farms;...our churches;...our universities, and our governmental departments.¹³

Notice the Fall-Redemption-Creation motifs in points one, two and three respectively. The religious language of “suffering”, “neo-messianic redemption”, and “creational order” is no coincidence. All humans have a Creation-Fall-Redemption narrative. For Taylor, as for our modern culture, this narrative avoids traditional dualisms. The narrative applies to every square inch of human existence.

Until modern culture abandons its obsession with efficiency, their ears will never be open to the gospel. Christians and non-Christians alike find agreement on one point. God is inefficient. He completely abandons economies of scale and the efficacy of standardization. He is unapologetically wasteful in utilizing every potential color, shape, size, skill, ability as he creates and recreates. God loves diversity. The ridiculously overdesigned creation is a glaring testimony to his lack of optimization. He also entrusts the care of this creation to a group of inadequately trained caretakers, opening the door to a myriad of failures as this group tries to get their minds around the vast diversity of interrelationships and the dynamic potential in creation. He has been known to patiently take thousands of years to teach a story of redemption and outline a process of reclamation, leaning heavily on the work of temporary interns and student teachers to point the way.

This truth about God’s inefficiency culminates in the practice of worship, the very act that shapes the core identity of the people of God. As theologian and Jaques Ellul scholar Marva Dawn writes...

To worship the Lord is – in the world’s eyes – a waste of time. It is indeed a royal waste of time, but a waste nonetheless. By engaging in it, we don’t accomplish anything useful in our societies terms...To understand worship as a royal waste of time is good for us because it frees us to enter the poverty of Christ...Worship of such a God immerses us in such a way of life, empowered by a Spirit who does not equip us with a means of power or control...but with the ability and humility to waste time in love of the neighbor.¹⁴

Sowing Seeds of Grace in an Engineering Profession

This puts Christian engineers in a predicament. If modern engineering in the contemporary shape and form that ABET and other accreditation bodies are seeking is foundationally antithetical to the message of the gospel, what place does an engineering

program have at a Christian institution? Or for that matter, on what basis can an engineer legitimately join the modern engineering profession? I would like to suggest that as the exiled people of God we are called to be a subversive presence in a Babylonian culture, so the engineer is called to service in a manner that will seek the prosperity of the culture around us, but do so in a way that does not bow to the local deities.

Right modeling: Modeling will look different for the Christian engineer in more than one way. Recognizing that all theory making is guided and directed by religious belief, not all prevalent theories or models will be embraced or endorsed by the Christian engineer. However, more importantly, a grace-driven engineer enters the act of modeling (mathematical or other form) with the objective of unearthing contingency, rather than predicting reality. The Christian engineer sees the values in modeling as establishing new boundaries of knowing and abstracting, rather than eliminating boundaries to knowing.

Right humility: With a clear recognition of boundaries and the potential for unresolvable mystery, that Christian engineer has allowed for humility to seek temporal solutions to temporal needs within temporal constraints. This frees the engineer from the utopian burdens all too often carried at great expense in the realm of scientific inquiry and technological development. Humility generated mystery is a powerful agent of emancipation.

Right design: The goal of any design should not be to control, but rather to enable. As Andy Crouch discusses in his book on power¹², the gift of power used well will result in a net power increase. The gift of power used to control, requires a net reduction in power as one creature (human or non-human) in creation must relinquish power to succumb to another creature. Design should always result in more net power transfer throughout the creation. This is the definition of designing for creational flourishing.

Right valuing: The Biblical concept of stewardship (of time, money, etc.) frequently gets confused with concepts of efficiency. This is unfortunate. The call to Biblical stewardship is a call to waste our time and energy in the tasks of creating, loving, and caring. The goal is rarely to make things cheaper, faster, or easier. In fact the goal in the Biblical concept of stewardship is to recklessly waste our time, money, and resources in the act of loving our world and all the creatures in it (humans and non-humans). This may mean cutting costs or time to better enable flourishing. But it also might mean embracing toil, suffering, and inefficiency in order to cultivate in the world around us a receptivity to grace. As Borgmann responds to those pursuing the technological promise of the eradication of trouble from the human condition, he states “Trouble is often the twin of grace, and if one cannot prosper, neither can the other”¹⁵. As hard as this may be for the modern engineering mindset to stomach, sometimes flourishing will involve a journey alongside pain, not a solution to the problem of pain. The motivations and designs of a Christian engineer should reflect this.

Preparing the Soil for Grace via an Engineering Curriculum

Grace by its very nature resists controlling, so to suggest pedagogical techniques designed to conjure up more grace in those who study engineering would undermine the

thesis of this paper. The goal of the Christian engineering instructor is not to teach grace, but rather to teach engineering in a manner that provides no barriers to grace. What does preparing the soil of our hearts to receive grace look like in the engineering curriculum?

First of all, no two classes should look the same. A course on design will approach this very different from a course on engineering economics, or a course on engineering analysis.

We recently piloted an example of grace cultivation in a technically abstract course taught in our program at Dordt College (Engineering 170: Programming for Instrumentation and Automation). The course was designed to teach structured programming to students in the context of instrumentation and automation components. It is a project-based class using tools such as Matlab and LabView. Initially, this course seems to be a poor candidate to explore overarching themes of grace receptivity. However, it is often in these abstract courses, that the unearthing of the theoretical presuppositions buried deeply in the course material provides a perfect stage for the surprise appearance of grace. Grace thrives on unexpected entries.

These two primary goals of the course are intended to develop of engineering habits that in many ways are independent of course content. Many students will not be aware that these objectives are designed specifically to cultivate grace receptivity. The first habit is the practice of embracing failure. Central to programming is the unexpected complication. Most of the time students spend in this course will be “wasted” time as they muddle around dead-end paths, patiently trouble-shoot, and experience unexpected results through tedious exploration. Practicing patient tenacity at any level is a preparation for grace receptivity. Secondly, an emphasis is placed on the development of technical empathy. Under the guise of effective GUI development is the more important recognition of an infinitely diverse human community being served by the developer’s program. This is a challenge, since a program that can only communicate in black and white, needs to accommodate a range of users with a spectrum of experiences, abilities, and assumptions.

On the content side of the course, the class explores through a series of scriptures reading, essays, and book excerpts the cultural concept of “Boolean thinking”. After a nearly a generation with computers, it is becoming evident that the proponents of a future with artificial intelligence have their primary thesis inverted. The artificial intelligence community claims that we will someday have computers that learn more like computers, what is disconcerting is that rather than computers becoming more like humans, our experience suggests that humans are becoming more like computers. We are becoming constrained by “Boolean thinking”.

It is good to first recognize that at the root of doing computer technology is Boolean thinking. While the complexity of today’s programs and applications mask this reality well, the reality has not changed. Computer technology has only a “1” or “0” to offer. Apart from the human interface, the “both-and” or the “maybe” results are not a possibility for digital machines. What is important to recognize, is that Boolean thinking is not an invention of our modern era. Boolean thinking is an ancient construct. It is a construct with the following characteristics:

1. The absence of any "maybe", "both/and", "almost there", "already here and yet to come" conclusions.
2. The rational assumption of "one best way" for everything.
3. An understanding of everything in black and white (either/or) categories.
4. The "predefined optimal process" and "generated results" are the only measures of importance (evaluated as "True/Win" or "False/Loss"). The journey is irrelevant.

As a whole, scriptural narrative is black and white. You are either in the light (Christ) or in darkness. In this sense the gospel is truly Boolean. Grey is not an option. However, while these two Boolean states prevail in and through scripture, the logical cause-effect paths of Boolean operators are conspicuously absent.

For this reason, the essays and readings of this class move through a series of readings intended to help students identify Boolean thinking in historical narrative and recognize how it emerges in conflict with the Biblical culture of grace. Each reading asked the students to reflect on how exposing absolutized Boolean thinking can make a difference in how they do their engineering design, analysis, or programming. It should also become evident to students that the key to understanding scripture is to understand grace. The all-of-life concept that is often foreign in the modern work and practice of engineering. An annotated summary of the semester assignments are provided in Appendix A.

The Conclusion of the Matter

The teacher in Ecclesiastes says it well, when he declares that we now have heard it all and concludes in chapter 3 and again in chapter 12, that there is an irrational mystery that trumps the chaotic irrationality of life. It is this. God picks up the pieces¹⁶. In one of the most graceless books of the Bible, the punch line can only be interpreted via grace. Not only the book, but meaning itself (i.e. life itself) is nothing apart from this lens. Humans have nothing better than to eat, drink, work, and take existential pleasure in their engineering, but only because we know that God picks up the pieces. A grace full engineer will never forget this.

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Appendix A: Example of Engaging Grace frameworks in the Engineering Classroom

EGR 170: Programming for Instrumentation and Automation

Dordt College Engineering Department

Readings and Reflections on Boolean Thinking

Instructor's Note: The planned rhythm of this reflection component is as follows. The students are asked to read the passage or excerpt before the next class. During the class we briefly reflect on the key points. The instructor suggests a particular hermeneutic related to the content of the class. Based on this commentary and their reading, students will submit an essay response before the following week.

Reading Response Essays: Students will be asked to write brief weekly response essays (approximately 100-300 words) following their reading of scripture, essays, or articles. To receive full credit, responses must be clearly communicated. These responses will be submitted electronically on Canvas@dordt. Students are asked to reflect on the following prompts:

Essays are evaluated on whether a thorough understanding of the reading is articulated and how well the arguments are communicated and supported.

WEEK 1 & 2 - READ - Psalm 115

Reflecting on the Boolean Culture: Professor Brue asserts that the way we think is influenced by the "Boolean mindset" more than we are aware of. Characteristics of the "Boolean Culture" are...

1. The absence of any "maybe", "both/and", "almost there", "already here and yet to come" conclusions essential to the Biblical narrative.
2. The assumption of "one best way" for everything
3. An understanding of everything in black and white (either/or) categories
4. The "predefined process" and "generated results" are the only measures of importance (evaluated as "True/Win" or "False/Loss"). The journey is irrelevant.

Boolean culture preceded (and gave birth to) the computer culture. However, the computer culture also shapes the way we think. Many technological futurists believe that computers will soon "think like humans". On the surface this may appear to be happening. However, it may be closer to the truth that humans are thinking more like computers and less like humans. This is a Biblical theme. We tend to worship what we make. When we worship what we make, we become more like what we make and less like who we were created to be.

1. Summarize the main point that the passage is trying to make?
2. How does the instructor connect this passage to this class? Do you think the argument has validity? Why or why not? Can you illustrate or refute with example?
3. How might programmers or engineers do their technical work differently after reading the assigned passage?

Instructor's Note: The key theme to develop in this reading is how inanimate constructs of our own making, easily become idols. But this is not the end of the story, once a human-molded

creature has been idolized (e.g. such as in the absolutizing of Boolean thinking), we don't simply worship it, we become like it. The goal is to have students recognize contemporary idolatry potential.

WEEK 3 & 4 - READ - II Kings 5 and Borgmann essay

"Contingency and Grace", by Albert Borgmann from Power Failure: Christianity in the Culture of Technology, Brazos Press, 2003. pp. 65-80.

1. Summarize the main point that the passage is trying to make?
2. What is the main point of the Borgmann reading? How is this related to II Kings 5?
3. How does the instructor connect this passage to this class? Do you think the argument has validity? Why or why not? Can you illustrate or refute with example?
4. How might programmers or engineers do their technical work differently after reading the assigned passage?

Instructor's Note: The story of Naaman has a wonderfully rich cross-section of characters all who hold certain cultural "Boolean" conditionals as absolute. As a result, each tries to create a new God of Israel in their own image (Namaan, the kings of Aram and Israel, and Gehazi). This manufactured image prevents them from truly seeing the kingdom of grace. The only characters in the narrative who have their ears open to the irrationality of this kingdom are the most unlikely ones, a slave girl and a servant of Aram. The goal is to have students recognize that accepted contemporary practices and constructs (as mundane and ordinary as "how healing happens") have the potential to occlude grace without a person seeing it. The answers that the digital age gives us to what it means to "know" occlude grace, as Borgmann asserts.

WEEK 5 & 6 - READ - Jonah

Remember and/or review "Contingency and Grace", by Albert Borgmann from Power Failure: Christianity in the Culture of Technology, Brazos Press, 2003. pp. 65-80.

In the context of your previous reading of Borgmann and your re-reading of Jonah...

1. What strikes you anew about the story of Jonah as you read it again (and possibly as you place it in the context of your coursework and extra course readings) for this class?
2. What is it in the "worldview framework" of Jonah that places him in the category of our modern technology (re-read the first three paragraphs of the Borgmann article for review)?
3. How is Jonah a very "modern" or "boolean thinker" when it comes to his understanding of how the world works?
4. What is the Biblical concept of idolatry (as noted in class)...How can a deep seated belief in God be a form of idolatry...what types of idolatry are presented in the Jonah story?

Instructor's Note: The story of Jonah is a powerful tragedy. A sometimes humorous, but always sad story of an idol created in a near likeness of the God of Israel – but without the characteristics that have always bothered us about God. The perfect God for a culture of transparency and control would stick to the prescribed operation. Disobedience = damnation.

To conclude otherwise would be analogous to getting a wrong answer in math class and opting to change the rules of addition to make it right.

WEEK 7 & 8 - READ - Philemon

1. What is the letter to Philemon about?
2. Why do you think the letter to Philemon is included in the canon of scripture that we include in our Bible?
3. Is the message of the book of historical interest only?
4. How does it speak to the world we live in today?

Instructor's Note: It is good for students to ask why the church (led by the spirit) moved to include a book like Philemon in the Biblical canon. At first glance, it looks like we are reading someone else's mail. However, the passage is not about a particular slavery incident. It is clearly a radical counter-cultural statement about the illegitimate hegemony Boolean thinking when it comes to place, station, and value of any human being (even Philemon). If the story unfolds as Paul hopes, it is Philemon who eventually gets his cultural chains broken. If this happens, receptivity to grace has again been realized.

WEEK 9 & 10 - READ - Colossians 1:1-14

READ: Colossians Remixed: Subverting the Empire, by Brian Walsh and Sylvia Keesmaat, Read Chapter 2 and Chapter 3.

You have read Albert Borgmann (in the excerpt from Power Failure) who discusses on a personal level how our culture of transparency and control (often the predominant culture of the digital technology industry) creates an environment hostile to the gospel way of life (which is a life of contingency and grace). In the book of Philemon, we read someone else's mail from a culture that we are not entirely familiar with. In understanding the context of the Roman empire, we begin to understand the relevance of the letter for our time and place. Slavery was the machinery of the empire culture, it was the technological mechanism of control - the assumed way in which things get built and produced. Paul says that the gospel message of freedom trumps the cultural machinery of the day and continues to do the same for us today. The narratives and translations from *Colossians Remixed* help us to see the "new machinery" of our day.

1. How does this "re-telling" of Colossians relate to our information and technology culture today?
2. How might programming development and information system design look different for Christ followers when we recognize the prevailing "empire" assumptions in today's world?

Instructor's Note: We scarcely recognize the cultural machines that surround us. The system assumptions are often the hardest uproot, because they often come with "natural law" baggage that declares them as "the way it works" ...as sure as gravity. Recognizing these in the digital culture is not an easy task. The resurrected Christ changes everything. At this point in the semester we begin to design and develop feedback control systems, so the notion of control becomes real as a technical tool.

The following example passages are often used to reinforce the theme that the Rosetta stone of scripture is grace, since without that interpretive key, existential discontinuities and conflicts within Scripture itself will arise.

Examples: Ecclesiastes 3, the Beatitudes, many different “the kingdom is like...” parables, the prodigal God parable, Joshua and Jericho, along with many other stories often misapplied.